

FORM PTO-1449  
(Rev. 2-32)U.S. Department of Commerce  
Patent and Trademark Office

Atty. Docket No.

01-661-A

Serial No.

10/034,451

INFORMATION DISCLOSURE  
STATEMENT BY APPLICANT

(Use several sheets if necessary)



Applicant:

Chad A. Mirkin, et al.

Filing Date:

December 28, 2001

Group:

4645

1637

## U.S. PATENT DOCUMENTS

Examiner Initial	Document Number	Date	Name	Class	Subclass	Filing Date if Appropriate
TS	1. 5,599,668	02/04/97	Stimpson, et al.			duplicate
TS	2. 5,990,479	11/23/99	Weiss, et al.			duplicate

## FOREIGN PATENT DOCUMENTS

Document Number	Date	Country	Class	Subclass	Translation Yes No

## OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc).

TS	3.	Stimpson, et al., "Real-time detection of DNA hybridization and melting on oligonucleotide arrays by using optical wave guides," <i>Proc. Natl. Acad. Sci.</i> , Vol. 92, pp. 6379-6383, California Institute of Technology (1995) U.S.
	4.	Storhoff, et al., "Strategies for Organizing Nanoparticles into Aggregate Structures and Functional Materials," <i>Journal of Cluster Science</i> , Vol. 8, No. 2, pp. 179-217, Plenum Publishing Corporation (1997) U.S.
TS	5.	Storhoff, et al., "One-Pot Colorimetric Differentiation of Polynucleotides with Single Base Imperfections Using Gold Nanoparticle Probes," <i>J. Am. Chem. Soc.</i> , Vol. 120, pp. 1961-1964, American Chemical Society (1998) U.S.
	6.	Velev, et al., "In Situ Assembly of Colloidal Particles into Miniaturized Biosensors," <i>Langmuir</i> , Vol. 15, No. 11, pp. 3693-3698, American Chemical Society (1999) U.S. <i>duplicate</i>
TS	7.	Zhu, et al., "The First Raman Spectrum of an Organic Monolayer on a High-Temperature Superconductor: Direct Spectroscopic Evidence for a Chemical Interaction between an Amine and YBa <sub>2</sub> Cu <sub>3</sub> O <sub>7-δ</sub> ," <i>J. Am. Chem. Soc.</i> , Vol. 119, pp. 235-236, American Chemical Society (1997) U.S.

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TS	8. ✓	Yguerabide, et al., "Light-Scattering Submicroscopic Particles as Highly Fluorescent Analogs and Their Use as Tracer Labels in Clinical and Biological Applications," I. Theory, <i>Analytical Biochemistry</i> , Vol. 262, pp. 137-156 (1998) U.S.
TS	9. ✓	Yguerabide, et al., "Light-Scattering Submicroscopic Particles as Highly Fluorescent Analogs and Their Use as Tracer Labels in Clinical and Biological Applications," II. Experimental Characterization, <i>Analytical Biochemistry</i> , Vol. 262, pp. 157-176 (1998) U.S.

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Examiner Initial		Document Number	Date	Name	Class	Subclass	Filing Date if Appropriate
TS	1. ✓	5,609,907	03/11/97	Natan			
TS	2. ✓	6,025,202	02/15/00	Natan			
TS	3. ✓	6,149,868	11/21/00	Natan, et al.			

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## FOREIGN PATENT DOCUMENTS

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TS	1. ✓	Brada, et al., "Golden Blot" – Detection of Polyclonal and Monoclonal Antibodies Bound to Antigens on Nitrocellulose by Protein A-Gold Complexes, <i>Analytical Biochemistry</i> , Vol. 42, pp. 79-83 (1984) U.S.
	2. ✓	Dunn, et al., "A Novel Method to Map Transcripts: Evidence for homology between an Adenovirus mRNA and Discrete Multiple Regions of the Viral Genome, <i>Cell</i> , Vol. 12, pp. 23-36, (1997) U.S.
	3. ✓	Hacker, "High performance Nanogold – Silver in situ hybridisation, <i>Eur. J. Histochem</i> , Vol. 42, pp. 111-120 (1998) U.S.
	4. ✓	Ranki, et al., "Sandwich hybridization as a convenient method for the detection of nucleic acids in crude samples," <i>Gene</i> , Vol. 21, pp. 77-85 (1983) U.S.
TS	5. ✓	Romano, et al., "An antiglobulin reagent labelled with colloidal gold for use in electron microscopy," <i>Immunochemistry</i> , Vol. 11, pp. 521-522 (1974) Great Britain

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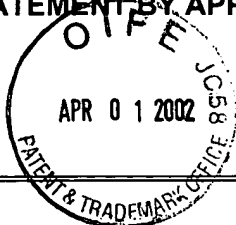
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TS	✓1.	4,193,983	3/18/80	Ullman et al.			o
	✓2.	4,256,834	3/17/81	Zuk et al.			o
	✓3.	4,261,968	4/14/81	Ullman et al.			o
	✓4.	4,313,734	2/2/82	Leuervering			o
	✓5.	4,318,707	3/9/82	Litman et al.			o
	✓6.	4,650,770	3/17/87	Liu et al.			o
	✓7.	4,713,348	12/15/87	Ullman			o
	✓8.	4,853,335	8/1/89	Olsen et al.			o
	✓9.	4,868,104	9/19/89	Kura et al.			o
	✓10.	5,225,064	7/6/93	Henkens et al.			o
	✓11.	5,294,369	3/15/94	Shigekawa et al.			o
TS	✓12.	5,384,073	1/24/95	Shigekawa et al.			o
	✓13.	5,384,265	1/24/95	Kidwell et al.			duplicate
TS	✓14.	5,460,831	10/24/95	Kossovsky et al.			o
	✓15.	5,472,881	12/5/95	Beebe et al.			duplicate
TS	✓16.	5,514,602	05/07/96	Brooks, Jr. et al.			o
	✓17.	5,521,289	5/28/96	Hainfeld et al.			o
	✓18.	5,543,158	8/6/96	Gref et al.			o
	✓19.	5,571,726	11/05/96	Brooks, Jr. et al.			o
	✓20.	5,665,582	9/9/97	Kaushch et al.			o
TS	✓21.	5,681,943	10/28/97	Letsinger et al.			o

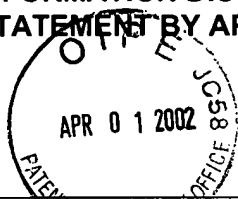
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TS	✓22.	WO 89/06801	7/27/89	PCT			o
	✓23.	WO 97/40181	10/30/97	PCT			o
TS	✓24.	WO 98/04740	2/5/98	PCT			o
	✓25.	WO 99/23258	10/30/98	PCT			o
TS	✓26.	0 630 974 A2	06/21/94	EPO			o
TS	✓27.	0 667 398 A2	8/16/95	EPO			o

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TS	✓28.	Alivisatos et al., "Organization of 'nanocrystal molecules' using DNA," <i>Nature</i> , Vol. 382, pp. 609-611 (1996)	o
	✓29.	Bain, et al., "Modeling Organic Surfaces with Self-Assembled Monolayers," <i>Angew. Chem. Int. Ed. Engl.</i> , Vol. 28, pp. 506-512 (1989)	o
	✓30.	Bradley, "The Chemistry of Transition Metal Colloids," <i>Clusters and Colloids: From Theory to Applications</i> , G. Schmid, Editor, BCH, Weinheim, New York, pp. 459-542 (1994)	o
	✓31.	Brust et al., "Novel Gold-Dithiol Nano-Networks with Non-Metallic Electronic Properties," <i>Adv. Mater.</i> , Vol. 7, pp. 795-797 (1995)	o
	✓32.	Chen et al., "A Specific Quadrilateral Synthesized from DNA Branched Junctions," <i>J. Am. Chem. Soc.</i> , Vol. 111, pp. 6402-6407 (1989)	o
	33.	Chen & Seeman, "Synthesis from DNA of a molecule with the connectivity of a cube," <i>Nature</i> , Vol. 350, pp. 631-633 (1991)	o
	✓34.	Chen et al., "Crystal Structure of a Four-Stranded Intercalated DNA: d(C <sub>4</sub> ) <sup>††</sup> <i>Biochem.</i> , Vol. 33, pp. 13540-13546 (1994)	o
TS	✓35.	Dagani, "Supramolecular Assemblies DNA to organize gold nanoparticles," <i>Chemical &amp; Engineering News</i> , p. 6-7, August 19, 1996	o

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		Filing Date: 12/28/01	Group: 4645-1637

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## OTHER DOCUMENTS - Including Author, Title, Date, Pertinent Pages, Etc.

TS	✓36.	Dubois & Nuzzo, "Synthesis, Structure, and Properties of Model Organic Surfaces," <i>Annu. Rev. Phys. Chem.</i> , Vol. 43, pp. 437-464 (1992)
	✓37.	Elghanian et al., "Selective Colorimetric Detection of Polynucleotides Based on the Distance-Dependent Optical Properties of Gold Nanoparticles," <i>Science</i> , Vol. 277, pp. 1078-1081 (1997)
	✓38.	Grabar et al., "Preparation and Characterization of Au Colloid Monolayers," <i>Anal. Chem.</i> Vol. 67, pp. 735-743 (1995)
	✓39.	Hacia et al., "Detection of heterozygous mutations in BRCA1 using high density oligonucleotide arrays and two-colour fluorescence analysis," <i>Nature Genet.</i> , Vol. 14, pp. 441-447 (1996)
	✓40.	Jacoby, "Nanoparticles change color on binding to nucleotide target," <i>Chemical &amp; Engineering News</i> , p. 10, August 25, 1997
	✓41.	Letsinger et al., "Use of Hydrophobic Substituents in Controlling Self-Assembly of Oligonucleotides," <i>J. Am. Chem. Soc.</i> , Vol. 115, pp. 7535-7536 (1993)
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	✓43.	Marsh et al., "A new DNA nanostructure, the G-wire, imaged by scanning probe microscopy," <i>Nucleic Acids Res.</i> , Vol. 23, pp. 696-700 (1995)
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	✓45.	Mirkin et al., "A DNA-based method for rationally assembling nanoparticles into macroscopic materials," <i>Nature</i> , Vol. 382, pp. 607-609 (1996)
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	✓47.	Mucic et al., "Synthesis and characterizations of DNA with ferrocenyl groups attached to their 5'-termini: electrochemical characterization of a redox-active nucleotide monolayer," <i>Chem. Commun.</i> , pp. 555-557 (1996)
	✓48.	Mulvaney, "Surface Plasmon Spectroscopy of Nanosized Metal Particles," <i>Langmuir</i> , Vol. 12, pp. 788-800 (1996)
TS	✓49.	Rabke-Clemmer et al., "Analysis of Functionalized DNA Adsorption on Au(111) Using Electron Spectroscopy," <i>Langmuir</i> , Vol. 10, pp. 1796-1800 (1994)

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TS	✓50.	Roubi, "MOLECULAR MACHINES - Nanodevice with rotating arms assembled from synthetic DNA," <i>Chemical &amp; Engineering News</i> , p. 13, (Jan. 1999)
	✓51.	Seeman et al., "Synthetic DNA knots and catenanes," <i>New J. Chem.</i> , Vol. 17, pp. 739-755 (1993)
	✓52.	Shaw & Wang, "Knotting of a DNA Chain During Ring Closure," <i>Science</i> , Vol. 260, pp. 533-536 (1993)
	✓53.	Shekhtman et al., "Stereostructure of replicative DNA catenanes from eukaryotic cells," <i>New J. Chem.</i> Vol. 17, pp. 757-763 (1993)
	✓54.	Smith and Feigon, "Quadruplex structure of Oxytricha telomeric DNA oligonucleotides," <i>Nature</i> , Vol. 356, pp. 164-168 (1992)
	✓55.	Thein et al., "The use of synthetic oligonucleotides as specific hybridization probes in the diagnosis of genetic disorders," 2 <sup>nd</sup> Ed., K.E. Davies, Ed., Oxford University Press, Oxford, New York, Tokyo, p. 21-33 (1993)
	✓56.	Wang et al., "Assembly and Characterization of Five-Arm and Six-Arm DNA Brached Junctions," <i>Biochem.</i> , Vol. 30, pp. 5667-5674 (1991)
	✓57.	Wang et al., "A DNA Aptamer Which Binds to and Inhibits Thrombin Exhibits a New Structural Motif for DNA," <i>Biochem.</i> , Vol. 32, pp. 1899-1904 (1993)
	✓58.	Weisbecker et al., "Molecular Self-Assembly of Aliphatic Thiols on Gold Colloids," <i>Langmuir</i> , Vol. 12, pp. 3763-3772 (1996)
	✓59.	Wells, "Unusual DNA Structures," <i>J. Biol. Chem.</i> , Vol. 263, pp. 1095-1098 (1988)
TS	✓60.	Zhang et al., "Informational Liposomes: Complexes Derived from Cholesteryl-conjugated Oligonucleotides and Liposomes," <i>Tetrahedron Lett.</i> , Vol. 37, pp. 6243-6246 (1996)

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FOREIGN PARENT DOCUMENTS								
		Document Number	Date	Country	Class	Subclass	Translation	
							Yes	No
TS	1. ✓	WO 92/04469	19 March 1992	PCT	_____	_____		X
TS	2. ✓	WO 90/02205	8 March 1990	PCT	_____	_____		X

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TS	1. ✓	5,288,609	02/08/94	Mroczkowski, et al.			
	2. ✓	5,284,748	02/22/94	Engelhardt, et al.			
	3. ✓	5,360,895	11/01/94	Hainfield, et al.			
	4. ✓	5,384,265	01/24/95	Kidwell, et al.			
	5. ✓	5,472,881	12/05/95	Beebe, et al.			
	6. ✓	5,599,668	02/04/97	Stimpson, et al.			
	7. ✓	5,637,508	06/10/97	Kidwell, et al.			
	8. ✓	5,751,018	05/12/98	Alivisatos, et al.			
	9. ✓	5,939,021	08/17/99	Hansen, et al.			
TS	10. ✓	5,990,479	11/23/99	Weiss, et al.			

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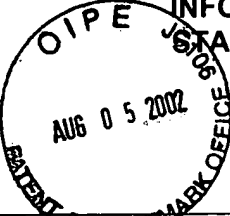
		Document Number	Date	Country	Class	Subclass	Translation Yes No
TS	11. ✓	WO 93/10564	27 May 93	PCT			
	12. ✓	WO 98/10289	12 March 98	PCT			
	13. ✓	WO 99/23258	14 May 99	PCT			
	14. ✓	WO 99/21934	06 May 99	PCT			
TS	15. ✓	WO 99/20789	29 April 99	PCT			

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TS	16. ✓	O.D. Velez, et al., "In Situ Assembly of Colloidal Particles into Miniaturized Biosensors," <i>Langmuir</i> , Vol. 15, No. 11, pp. 3693-3698, May 25, 1999
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TS	2. ✓	Alivisatos, A. P., et al., "Organization of 'nanocrystal molecules' using DNA," <i>Nature</i> , Volume 382, p. 609-611, (1996)	duplicate
TS	3. ✓	Chan, W. C. W., et al., "Quantum Dot Bioconjugates for Ultrasensitive Nonisotopic Detection," <i>Science</i> , Volume 281, p. 2016-2018, (1998)	
	4. ✓	He, L., et al., "Colloidal Au-Enhanced Surface Plasmon Resonance for Ultrasensitive Detection of DNA Hybridization," <i>Journal of the American Chemical Society</i> , Volume 122, p. 9071-9077, (2000)	
	5. ✓	Link, S., "Alloy Formation of Gold-Silver Nanoparticles and the Dependence of the Plasmon Absorption on Their Composition," <i>Journal of Physical Chemistry B</i> , , 103, 3529, (1999)	
TS	6. ✓	Mann, S., et al., "Biologically Programmed Nanoparticle Assembly," <i>Advanced Materials</i> , Volume 12, p. 147-150, (2000)	

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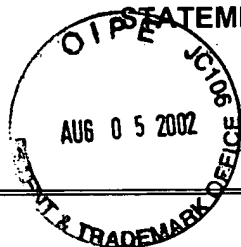
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TS	✓ 7.	Martin, B. R., et al., "Orthogonal Self-Assembly on Colloidal Gold-Platinum Nanorods," <i>Advanced Materials</i> , Volume 11, p. 1021-1025, 1999
	✓ 8.	Mattoussi, H., et al., "Self-assembly of CdSe-ZnS quantum dot bioconjugates using an engineered recombinant protein," <i>Journal of the American Chemical Society</i> , Volume 122, p. 12142-12150, 2000
	✓ 9.	Mitchell, G. P., et al., "Programmed assembly of DNA functionalized quantum dots," <i>Journal of the American Chemical Society</i> , Volume 121, p. 8122-8123, 1999
TS	✓ 10.	Mulvaney, P., et al., "Electrochemistry of Multilayer Colloids: Preparation and Absorption Spectrum of Gold-Coated Silver Particles," <i>Journal of Physical Chemistry</i> , Volume 97, p. 7061-7064, 1993

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	12. ✓	Pathak, S., et al., "Hydroxylated quantum dots as luminescent probes for in situ hybridization," <i>Journal of the American Chemical Society</i> , Volume 123, p. 4103-4104, 2001
	13. ✓	Rivas, L., et al., "Mixed Silver/Gold Colloids: A Study of Their Formation, Morphology and Surface-enhanced Raman Activity," <i>Langmuir</i> , Volume 16, p. 9722-9728, 2000
	14. ✓	Schrock, E., et al., "Multicolor spectral karyotyping of human chromosomes," <i>Science</i> , Volume 273, p. 494-497, 1996
TS	15. ✓	Taton, T. A., "Scanometric DNA array detection with nanoparticle probes," <i>Science</i> , Volume 289, p. 1757-1760, 1999

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TS	17. ✓	Ung, T., et al., "Controlled method for silica coating of silver colloids: influence of coating on the rate of chemical reactions," <i>Langmuir</i> , Volume 14, p. 3740-3748, 1998

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✓ TS	1. ✓	5,830,986	11/03/98	Merrill, et al.	528	332	10/28/96 <sup>6</sup>
	2. ✓	5,900,481	05/04/99	Lough, et al.	536	55.3	11/06/96 <sup>6</sup>
	3. ✓	6,203,989	03/20/01	Goldberg, et al.	435	6	03/25/99 <sup>6</sup>
	4. ✓	6,251,303	06/26/01	Bawendi, et al.	252	301.4R	09/18/98 <sup>6</sup>
	5. ✓	6,277,489	08/21/01	Abbott, et al.	428	403	12/04/98
	6. ✓	6,306,610	10/23/01	Bawendi, et al.	435	7.1	09/17/99 <sup>6</sup>
	7. ✓	6,361,944	03/26/02	Mirkin, et al.	435	6	06/25/99 <sup>6</sup>
	8. ✓	6,365,418	04/02/02	Wagner, et al.	436	518	05/18/00 <sup>3</sup>
TS	9. ✓	6,417,340	07/09/02	Mirkin, et al.	536	23.1	10/20/00 <sup>6</sup>

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TS	10. ✓	WO 93/25709	23 December 1993	PCT				•
	11. ✓	WO 98/04740	5 February 1998	PCT				•
	12. ✓	WO 98/17317	30 April 1998	PCT				X <sup>6</sup>
	13. ✓	WO 99/60169	25 November 1999	PCT				•
	14. ✓	WO 00/33079	8 June 2002	PCT				•
TS	15. ✓	WO 01/00876	4 January 2001	PCT				•

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TS	16. ✓	WO 01/51665	19 July 2001	PCT			
	17. ✓	WO 01/73123	4 October 2001	PCT			
	18. ✓	WO 01/86301	15 November 2001	PCT			X
	19. ✓	WO 02/04681	17 January 2002	PCT			
	20. ✓	WO 02/18643	7 March 2002	PCT			
	21. ✓	WO 02/36169	10 May 2002	PCT			
	22. ✓	WO 02/46483	13 June 2002	PCT			
TS	23. ✓	WO 02/46472	13 June 2002	PCT			

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TS	24. ✓	Letsinger, R., et al., "Chemistry of Oligonucleotide-Gold Nanoparticle Conjugates," <i>Phosphorus, Sulfur and Silicon</i> , Volume 144, p. 359-362 (1999)
TS	25. ✓	Letsinger, R., et al., "Use of a Steroid Cyclic Disulfide Anchor in Constructing Gold Nanoparticle—Oligonucleotide Conjugates," <i>Bioconjugate Chem</i> , p. 289-291 (2000)

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	27. ✓	Nuzzo R., et al., "Spontaneously Organized Molecular Assemblies. 3. Preparation and Properties of Solution Adsorbed Monolayers of Organic Disulfides on Gold Surfaces," <i>J. Am Chem. Soc.</i> , Volume 109, p. 2358-2368 (1987)
	28. ✓	Otsuka, H., et al., "Quantitative and Reversible Lectin-Induced Association of Gold Nanoparticles Modified with $\alpha$ -Lactosyl- $\omega$ -mercapto-poly(ethyleneglycol)," <i>J. Am Chem. Soc.</i> , Volume 123, p. 8226-8230 (2001)
TS	29. ✓	Wuelfing, P., et al., "Nanometer Gold Clusters Protected by Surface-Bound Monolayers of Thiolated Poly(ethylene glycol) Polymer Electrolyte," <i>J. Am Chem. Soc.</i> , Volume 120, p. 12696-12697 (1998)

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